The Cell Surface in Animal Embryogenesis and Development

Cell Surface Reviews: Volume 1

Edited by George Poste and Garth L. Nicolson
North-Holland; Amsterdam, 1976
xxiv + 766 pages. Dfl 220.00, $ 89.95

Another tome on membranes, and only the first of a series at that! Librarians and scientists groan. Five years ago there were hardly any books or reviews on membranes, and now a new one appears practically every month. Enough is enough! But stay, the title of this series is *Cell Surface Reviews.* Is not the cell surface different from other membranes? Of course not, the molecular biologists retort. A membrane is a phospholipid bilayer with proteins embedded in it, whatever its source. The properties of a membrane are dictated solely by the fluidity of its lipids and by the enzymic capability of its proteins. Whether that capability is oxidative phosphorylation and electron transport, as in mitochondria, or phospholipid synthesis and the binding of ribosomes, as in endoplasmic reticulum, or the facilitated uptake of nutrients, as in the plasma membrane, is secondary to the basic structure of membranes. And about that structure we now know a great deal; any advance in knowledge concerning the interaction between phospholipids and proteins is adequately brought to our attention by the existing journals and reviews.

Such arguments miss a key point. It concerns the function of membranes. Whereas the function of the inner mitochondrial membrane, of the endoplasmic reticulum, or of the nuclear membrane is the same in liver, pancreas or heart, the function of the plasma membrane differs from cell to cell. In fact much of the biological specificity of cells resides at the cell surface. The ability of intestinal and renal epithelial cells to absorb large quantities of sugars and amino acids is due to the presence of a specialized 'brush border' of microvilli; the secretion by B lymphocytes of just one specific immunoglobulin is due to the presence of that immunoglobulin at the cell surface; the ability of macrophages to digest bacteria and viruses is due to the dynamic nature of their plasma membrane; the secretion of steroids by the adrenal is triggered by the presence of a specific receptor at the cell surface. In short, the cell surface does merit more discussion than other membranes, and it is appropriate for that discussion to take place in cellular, as well as in molecular, terms. *Cell Surface Reviews* is a welcome addition to literature.

Volume 1, The cell surface in animal embryogenesis and development, seems particularly interesting since it is just developmental events like embryogenesis and organogenesis that are ripe for discussion at the level of membrane components. The volume has excellent chapters on fertilization (R. B. L. Gwarkin), the implanting mouse blastocyst (M. I. Sherman and L. R. Wudl), inductive tissue interactions (L. Saxén et al.), and the development of vertebrate limb (D. A. Ede), heart (F. J. Manasek) and lymphocytes (I. Goldschueider and R. W. Barton). The role of the placenta in supplying nutrients to the developing fetus (R. K. Miller, T. R. Koszalka and R. L. Brent) and in preventing its rejection as being 'foreign' to maternal tissues (M. Edidin), receives attention. During early development, and indeed throughout life in the case of the haematopoietic system, certain cells move from one site to another. The mechanics of that movement (J. P. Trinkaus) and the recognition of, and adhesion to, new sites (D. E. Maslow) are discussed in a systematic manner. The fundamental problem of development, namely the creation of cellular heterogeneity, is considered by D. McMahon and C. West; they present a stimulating hypothesis attempting to relate intracellular metabolism to alterations at the cell surface. The extent to which inter-cellular communication contributes to embryonic development is evaluated by J. D. Sheridan. Finally it is refreshing to see an article on cytokinesis (J. M. Arnold). Whether this is strictly speaking a developmental event

or not, it is clearly one in which the cell surface is altered to a greater extent than in any other situation.

The editors, G. Poste and G. L. Nicolson, are to be congratulated on assembling a well-presented and comprehensive series of articles. How much better such articles read, and how much more information they contain, than the presentations of participants at a meeting that are subsequently published in 'book' form with deceptively comprehensive-sounding titles! Has anything of import been omitted from this volume? A critic might at first sight point to the absence of a chapter on hormones, and 'developmental' hormones at that. Yet neither thyroxine, nor steroids including ecdysone, act at the cell surface. Of the hormones that do, it is not so much the binding of hormone to cell surface receptor that is the developmental event, as the synthesis of the receptor itself. A chapter on this topic would make a useful contribution to a future volume.

Finally, the price. Can libraries and individual readers really be expected to pay $ 90 for only one volume of this series? The answer would appear to be yes. For these 766 pages of clearly-printed and well-illustrated articles, including nearly 20 pages of valuable index, compare not too unfavourably with, for example, 420 pages of BBA Biomembranes at $ 38. As the cost of carrying out research escalates, so does the price one has to pay to read about it.

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Virus Infection and the Cell Surface

Cell Surface Reviews: Volume 2

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This collection of articles forms volume 2 of *Cell Surface Reviews*. As the title implies, the volume covers a narrower range of topics than does volume 1 (The Cell Surface in Animal Embryogenesis and Development). It is therefore less easy to recommend to the general reader, especially at the price of £ 32.23. For the virologist or biochemist interested in the interaction between viruses and cells, on the other hand, there is a wealth of information in the 9 articles covering some 330 pages.

The volume begins with a useful review of 'Host and tissue specificities in virus infections of animals' by H. Smith. The next three chapters, 'Structure and assembly of viral envelopes' (R. Rott and H.-D. Klenk), 'Virus–erythrocyte interactions' (T. Bächi, J. E. Deas and C. Howe) and 'Cell fusion by Sendai virus' (Y. Hosaka and K. Shimizu) cover a certain amount of common ground. This is a pity, especially as we are promised a volume (number 5) devoted entirely to Membrane Fusion. J. M. Tiffany provides an authoritative review on 'The interaction of viruses with model membranes'. But just how useful are models in elucidating the molecular basis of biological phenomena? Our current knowledge of the structure and function of DNA, of haemoglobin, insulin or lysozyme, has relied less on models than on the real thing. And have not the major advances in cell surface biochemistry been due to experiments like those of Frye and Edidin, of Singer and Nicolson, of Marchesi, Bretscher and others, in which the components of natural membranes have been studied? While it is true that a study of liposomes has revealed much interesting data on the passage of molecules through lipids, and of fusion between lipid bilayers, this is of limited value if it turns out that most molecules cross membranes by way of protein channels, and that fusion between membranes is triggered by interactions with membrane proteins.

Chapters on 'Virus–host interactions in 'slow' virus